FOREST INSECT AND DISEASE CONDITIONS IN VERMONT

CALENDAR YEAR 1982

Prepared by

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AGENCY OF ENVIRONMENTAL CONSERVATION
DEPARTMENT OF FORESTS, PARKS AND RECREATION
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INTRODUCTION

The information in the report is based largely on aerial surveys to detect defoliation, as well as ground surveys and observations of Forest Resource Protection personnel and other forestry staff. An aerial survey was flown in southern Vermont in early July and in northern Vermont in August. An additional survey was flown in early July in parts of northern Vermont to detect spruce budworm defoliation and forest tent caterpillar damage.

May, July and August were dry, resulting in a number of drought related stress problems, including early fall color, scorch and chlorosis of leaves on shallow sites, especially at high elevations. The early fall color interfered with the August aerial survey, resulting in incomplete acreage figures.

Aerial detection was further complicated by a very heavy seed crop on red maple and to a lesser extent sugar maple. Most red maples exhibited a light brown color early in the summer, which resulted in bare tops reminiscent of defoliation later during the summer when the seeds had fallen.

VERMONT

INSECT AND DISEASE HIGHLIGHTS

1982

Gypsy Moth populations collapsed, with only 10,430 acres defoliated statewide; down from 48,979 acres of moderate to heavy defoliation in 1981.

Forest Tent Caterpillar defoliated 322,605 acres in 1982 compared to 117,000 acres in 1981. Population levels dropped to mostly light-moderate in northern Vermont, and collapsed in southern Vermont.

Maple Leaf Cutter populations are increasing in northern Vermont where there are 13,671 acres of noticeable defoliation compared to 1,350 acres in 1981. Damage levels are down in southern Vermont.

Saddled Prominent populations continued at low levels with no defoliation visible from the air.

Birch Skeletonizer and Birch Leaf Folder combined to cause widespread late defoliation of yellow and white birch in excess of 38,250 acres.

Spruce Budworm damage continues to increase with 153,852 acres of defoliation and tree mortality in excess of 10 percent occurring on about 60,000 of these acres. 750 infested acres in the Greensboro area were experimentally sprayed with Bacillus thuringiensis in late May.

Scleroderris Canker was not detected in any new locations this year, although rates of infection appear to have increased in infected plantations. The disease remains present in 94 plantations comprising 767 acres.

Larch Decline is now present on about 9000 acres, somewhat increased from 1981. Fewer trees appear to be dying than in the past.

Red Maples produced an unusually heavy seed crop this year, resulting in many bare tops after seeds had fallen.

Hardwood Defoliators

Gypsy moth, Lymantria dispar, populations collapsed with only 10,430 acres defoliated statewide (Table 1, Map 1) compared to 48,979 acres in 1981. Collapse is attributed to starvation and wilt disease. One area in Colchester that was detected this year was last defoliated in 1977-78. Heavy snow cover and lack of extreme temperatures during the past winter probably resulted in good survival of the relatively low numbers of large egg masses that were seen in this area in 1981.

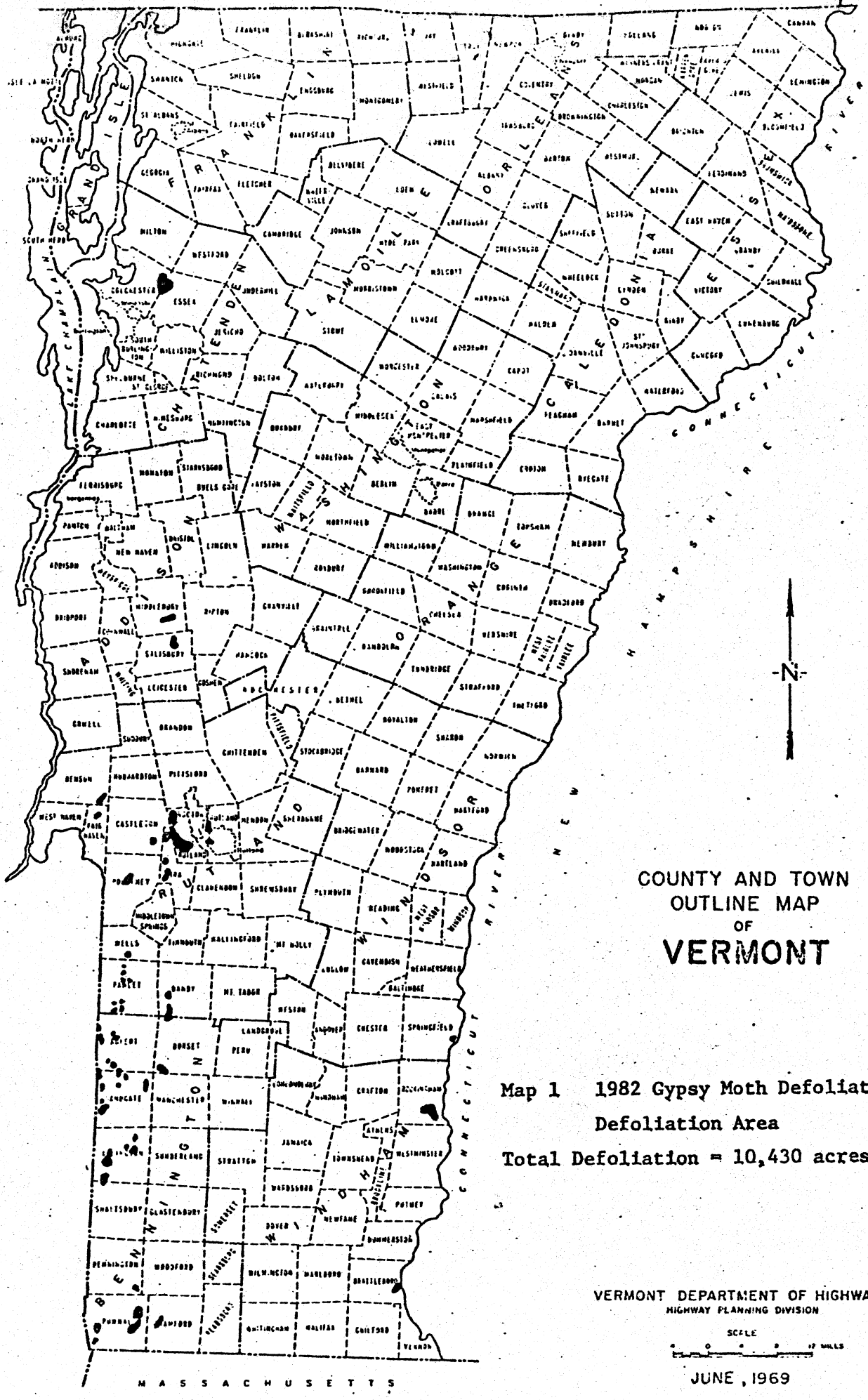
TABLE 1 1982 GYPSY MOTH DEFOLIATION

County	Acres Defoliated			
	Light	Moderate	Heavy	Total
Addison	0	225	0	0
Bennington	3,794	325	0	4,119
Chittenden	0	0	383	383
Rutland	3,354	607	0	3,961
Windham	93	0	1,612	1,705
Windsor	0	37	0	37
Total	7,241	1,194	1,995	10,430

Town administered suppression projects were carried out on 230 acres in the town of Rockingham and 23 acres in the town of Westminster. Sevin 80S was applied. Although seven towns in the region had expressed an interest in federal assistance, no towns participated in the cost share program because only 12.5% of the cost was slated to be paid by the federal government. Technical assistance was provided to a landowner in Sandgate, where carbaryl was applied to 100 acres.

A new formulation of Bt, bactosphene, was tested on two sites in Bennington County. Twelve b.i.u. were applied to caterpillars mostly in the first and second instars. Mortality of first instar larvae occurred within four or five days. Wilt symptom development on second and third instar larvae was accelerated in the spray areas over non-spray areas. Caterpillars in these instars did not appear to be killed outright by the insecticide. Adjacent to the thirty acre spray block, wilt disease caused population collapse. The disease is thought to have been responsible for population collapse in the spray area as well. In the 100 acre spray block, survival of second and third instar larvae was sufficient to justify a second application of bactosphene at 8 b.i.u. Although some defoliation did occur in this block, refoliation was prevented.

An egg mass insecticide containing dylox, Spray N Kill, was tested. Lab results were inconclusive. In the field, the product did not prevent hatch, but the larvae died before leaving the egg mass.



COUNTY AND TOWN OUTLINE MAP OF VERMONT

Map 1 1982 Gypsy Moth Defoliation

Defoliation Area

Total Defoliation = 10,430 acres

VERMONT DEPARTMENT OF HIGHWAYS
HIGHWAY PLANNING DIVISION

SCALE

JUNE, 1969

Gypsy moth populations are expected to remain at low levels in 1983. In some defoliated areas, pupation occurred prematurely, with low emergence success, and small egg masses being laid.

Forest Tent Caterpillar, Malacosoma disstria, was responsible for a dramatic increase in number of acres defoliated in northern Vermont, while populations collapsed in southern Vermont. In most areas, the severity of defoliation was down. A total of 322,605 acres of defoliation were detected (Table 2, Map 2), compared to 117,000 acres in 1981. The expanding front of the current infestation appears to be along the northeastern edge, especially in the towns of Woodbury and Worcester in Washington County and Newport and Irasburg in Orleans County. Light defoliation was also detected in Essex County for the first time.

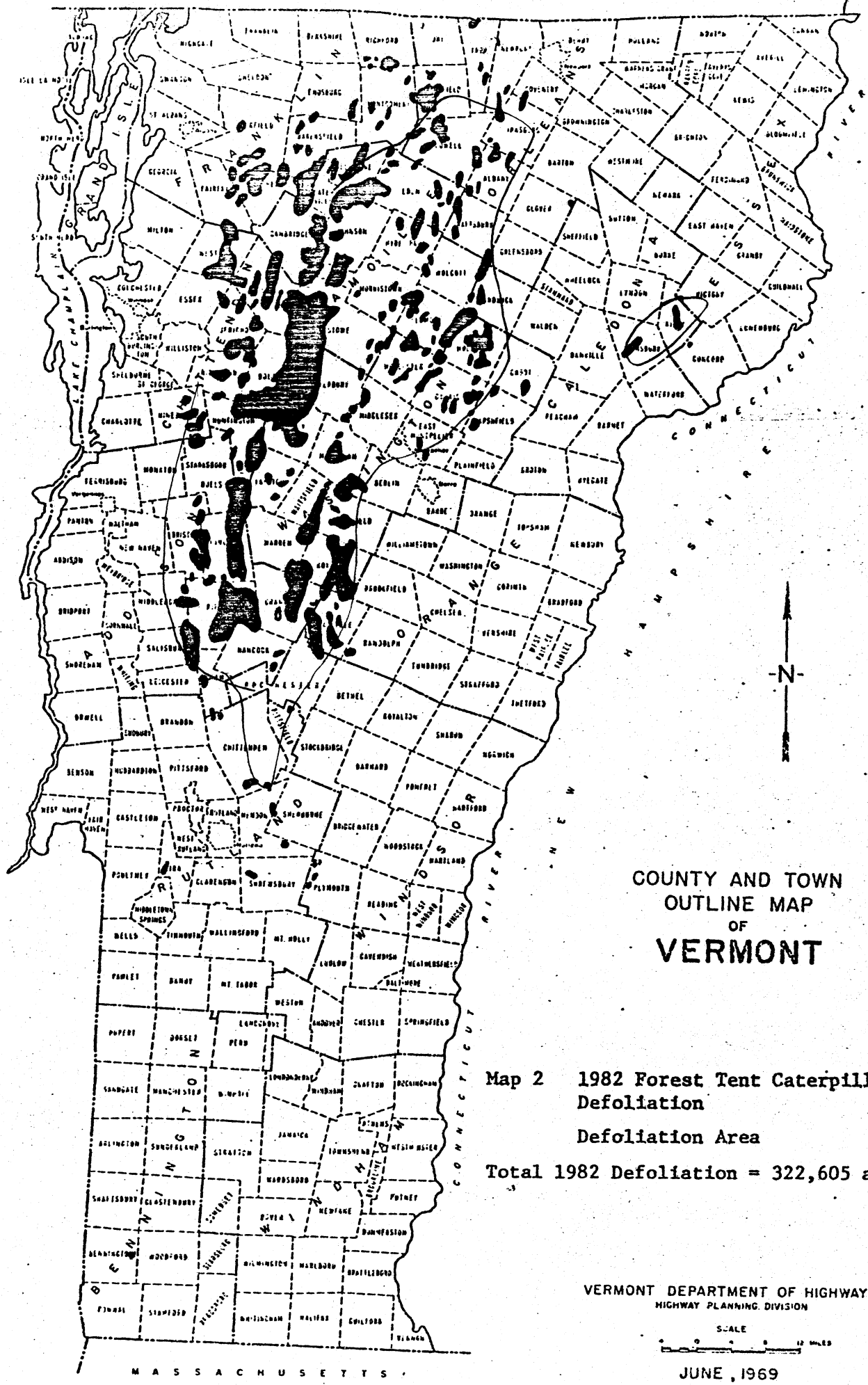
TABLE 2 FOREST TENT CATERPILLAR DEFOLIATION

	Acres Defoliated			
County	Light	Moderate	Heavy	Total
Addison	4,528	14,715	23,104	42,347
Caledonia	1,141	1,512	960	3,613
Chittenden	9,724	41,714	15,515	66,953
Essex	1,147	0	0	1,147
Franklin	11,623	16,556	2,254	30,433
Lamoille	18,744	45,383	13,805	77,932
Orange	4,661	0	0	4,661
Orleans	8,895	9,356	0	18,251
Rutland	912	0	0	912
Washington	50,431	19,799	6,126	76,356
Total	110,806	149,035	61,764	322,605

Starvation contributed to population decline in southern Vermont. Egg mass counts had been high in some ridgetop areas where no defoliation occurred.

In areas which had been defoliated several years in a row, egg masses were often small and poorly formed, sometimes lacking the protective outer covering. Hatched larvae in these areas developed slowly, and often died in early instars without evidence of wilt. Poor foliage quality may have been responsible in part for the poor success of young larvae.

Forest tent caterpillar did not cause much damage in sugarbushes this year. Although no requests for assistance in aerial spraying for this insect in sugarbushes were received, an evening aerial application of Dipel was applied to 27 acres of Gifford Woods State Park to protect foliage and prevent caterpillar nuisance at the park.



COUNTY AND TOWN OUTLINE MAP OF VERMONT

Map 2 1982 Forest Tent Caterpillar Defoliation

Defoliation Area

Total 1982 Defoliation = 322,605 acres

VERMONT DEPARTMENT OF HIGHWAYS
HIGHWAY PLANNING DIVISION

SCALE

JUNE, 1969

Tree dieback and mortality following past defoliations became much more evident in certain locations, especially at the higher elevations; i.e., above 1700 feet. Areas thinned just prior to or during the early stages of the outbreak, leaving mostly favored host species such as sugar maple and white ash, have suffered the greatest defoliation and subsequent mortality. Portions of stands with the heaviest losses are most often characterized by a dominance of pole and young sawtimber-size sugar maple and low basal areas compared to the rest of the stand. The main effect is thought to be one of concentrating the same number of insects on their favorite food in the form of fewer trees, which often have much smaller crowns than many of the trees that were removed.

One example of this concentration effect was seen in a lighly infested, overstocked old sugarbush in Hanksville that was being heavily thinned this past spring for sugarbush improvement. Egg mass counts were one-third the level required to predict noticeable defoliation. Yet the thinned trees were showing noticeable defoliation on 1 June and received up to 60 percent defoliation by mid-summer while only very light defoliation occurred in the unthinned portions of the stand.

One northern hardwood stand in Waterville received so much mortality following heavy forest tent caterpillar defoliation in 1980-81 that about 20 acres of the worst damage was recently marked for salvage. One complication in this stand is that portions at the upper elevations (above 1800 feet) probably received late frost damage to emerging leaves in 1981 as well. Areas of the stand with the greatest losses were predominantly sugar maple (90%+) with the majority of trees in the pole or small sawtimber-size class. 27,000 board feet and 160 cords were recently marked for removal. 67 percent of the sawlog quality trees and 79 percent of the fuelwood quality trees were dead or dying (less than 10 percent crown remaining) when tallied in September 1982. Mortality was greatest among the 8-12 inch diameter sugar maples.

Mortality continued to occur in the 389 acre State owned sugarbush lease area on Saltash Mountain, which was defoliated from 1979 to 1981. A 158 acre piece which had been thinned in 1974 to increase the proportion of sugar maple to 85% of basal area was defoliated an additional year (1978). The proportion of dead trees in this area increased from 8% in 1981 to 11% in 1982 (Table 3).

TABLE 3 TREE CONDITION IN SALTASH SALE AREA BY YEAR

	Percent Live Crown				
Year	75-100	50-75	25-50	1-25	0
1981	43	21	12	16	8
1982	36	24	13	16	11

Because mortality is expected to continue in 1983 and because of the low quality of the growing stock from 7 years of tapping and a high incidence (26%) of logging wounds, this 158 acre area is scheduled to be clearcut in winter 1983. Sale volumes are 2800 cords of fuelwood and 180 MBF of sawtimber, 89% of which is sugar maple.

Ambrosia Beetles, Xyloterinus politus, and associated bluestain have caused some degrade in the quality of the sawtimber.

Pupal parasitism in the Ayers Block of Cotton Brook in Stowe increased from 31 percent in 1980 and 45 percent in 1981 to 99 percent in 1982, indicating a probable population collapse. The area surveyed received moderate overall defoliation in '80 and '81, but as with other stands, individual trees in a previously thinned portion of the stand comprised mostly of sugar maple poletimber (basal area of 50) received heavy defoliation. Outside of the thinned areas, the sugar maples already stressed by heartrot, canker fungi, etc., appeared to be receiving the most defoliation in early June.

The large acreage of light to moderate forest tent caterpillar defoliation encompassing areas that received heavier defoliation in 1981 is seen as a sign that populations are declining further. Some of the newer infestations are expected to continue in 1983, but acres of defoliation are expected to decrease. Recent requests for egg mass surveys have come not from sugarbush owners but from owners of northern hardwood timber stands who have heard about the possible detrimental effects of thinning during an outbreak. They wish to know the insect status before deciding whether to go ahead with proposed thinning operations.

Maple Leaf Cutter, Paraclemensia acerifoliella, populations increased in many areas of northern Vermont, particularly in Chittenden, Franklin, Orange and Washington Counties (Table 4, Map 3). Even though early fall color precluded aerial mapping of much of this defoliation, 13,671 acres were detected compared to 1,350 acres in 1981. Defoliation in many stands was confined to the mid and lower crowns of sugar maple, but in some cases, removal of the top leaves by forest tent caterpillar made this defoliation more visible from the air.

TABLE 4 1982 MAPLE LEAF CUTTER DEFOLIATION

	Acres Defoliated			
County	Light (30%)	Moderate (30-60%)	Heavy (60%+)	Total
Chittenden	145	7,621	0	7,766
Franklin	0	890	128	1,018
Orange	0	0	2,383	2,383
Washington	0	1,493	1,011	2,504
Total	145	10,004	3,522	13,671

Many stands that received light to moderate defoliation by forest tent caterpillar in June were observed to have moderate maple leaf cutter defoliation on many of the remaining leaves by late August. This is the first time that these two insects have been observed to occur successively over large areas during the same year.

In southern Vermont, damage was generally down from previous year with only light to moderate defoliation observed. The low level of damage did not justify our aerial survey for this pest. Populations may be increasing in Bennington County.

Assistance was provided to landowners for control of this insect in a 10 acre sugarbush in Fayston and a 20 acre sugarbush in Braintree. Even though emergence from the mines was only about 50 percent complete in the Fayston sugarbush at the time of spraying, compared to 90 percent in Braintree, both areas received excellent control from an aerial application of Sevin 80S plus Plyac spreader-sticker. The material was applied 9 July at the rate of 1 lb. of active ingredient per acre in 1 gallon water.

Saddled Prominent, Heterocampa guttivata, populations collapsed in southern Vermont and continued at low levels in northern Vermont, with no defoliation visible from the air. Light populations remain in the 850 acres in the towns of Westmore, Barton, Sutton and Groton, which have received light to moderate defoliation in the past. These populations never developed to the extent expected and caused only trace to light defoliation this year. Starvation and wilt were common last summer. Eggs that were laid this spring from the surviving insects were very heavily parasitized.

Although no new areas of mortality following saddled prominent were observed, tree condition is deteriorating in areas that were observed in 1981. Dead and moribund trees exceed half of the growing in some of these areas.

Three areas that were intensively surveyed in 1981 for extent of decline and mortality following defoliation by saddled prominent in 1980 were re-evaluated in July, 1982. These stands were comprised primarily of pole and young sawtimber-size sugar maple (78%+). Actual mortality in 1982 was a little more than twice the average in 1981 for the two stands (Table 5).

TABLE 5 TREE CONDITION IN 1981 AND 1982 FOR THREE STANDS FOLLOWING HEAVY DEFOLIATION BY SADDLED PROMINENT

Town	Site Quality for Northern Hardwoods	Percent of Trees			
		Dying[1]	Dead	Dying[1]	Dead
		1981		1982	
Sharon	Good	33	9	39	12
Chelsea	Good	38	21	17	53
Vershire	Good to Excellent	30	23	14	39

1. Trees that were rated poor according to crown condition. In Actuality, these trees averaged 14 percent live crown in each stand when first rated in 1981.

On the good site in Chelsea, 77 percent of the trees with only 10 percent live crown in 1981 and 27 of the trees with 40 percent live crown in 1981, died within the following year. On the good to excellent site in Vershire, 57 percent of the trees with 10 percent live crown in 1981 and none of the trees with 40 percent live crown in 1981 died within the following year.

A salvage cut was operated on 80 acres in Downer State Forest. All stems except ash under 14" DBH were removed.

Birch Skeletonizer, Bucculatrix canadensisella, and Birch Leaf Folder, Ancylis discigerana combined to cause widespread late defoliation of yellow and white birch throughout much of the State. Yellow birches in affected stands contained large numbers of both insects and were the most severely defoliated, while white birch contained mostly the skeletonizer.

Flights of the spear marked moth, Rheumaptera hastata, were very heavy in Windsor County. This insect is presumed to be responsible for some of the birch damage there, although the larvae were not observed.

The 38,250 acres of defoliation detected (Table 6) are an underestimate of the actual acreage since fall color made it difficult to detect all the damage, especially in the Northeast Kingdom, and damage did not justify a survey in southern Vermont. Even birches in unmapped areas where they were not a major stand component suffered some defoliation from these insects. Orange County had the most damage, although this may mostly reflect the ability to detect the damage here compared to areas further north.

TABLE 6 1982 BIRCH SKELETONIZER-BIRCH LEAF FOLDER DEFOLIATION

	Acres Defoliated			
County	Light (<30%)	Moderate (30-60%)	Heavy (60%+)	Total
Caledonia	0	0	1,222	1,222
Essex[1]	0	0	7,688	7,688
Lamoille	0	397	337	734
Orange	0	0	19,524	19,524
Orleans	0	0	505	505
Washington	717	2,382	1,118	4,217
Total	717	2,779	34,754	38,250

1. Acres reported are for an area detected in 1981 and known to be heavily defoliated again this year as no aerial detection was possible in Essex County in 1982.

Dieback and mortality in some birch areas may be expected in the coming years, especially where bronze birch borer becomes established.

Maple Webworm, Tetralopha asperatella, was again common on sugar maples in northern Vermont, but caused mostly light defoliation late in the season. This insect was very abundant in a sapling stand of sugar maples in Johnson that had received light to moderate defoliate from forest tent caterpillar earlier in the summer.

Maple Trumpet Skeletonizer, Epinotia aceriella, caused widespread light defoliation of sugar maple again this year.

A solitary leaf roller, Sparganothis pettitana, was not as evident on sugar maple as in previous years, although occasional light damage was detected, especially on roadside maples in Caledonia and Orleans Counties.

Bruce Spanworm, Operophtera bruceata, caused light to moderate defoliation of mostly understory trees, especially sugar maple, in scattered locations. Often the insect was observed in areas defoliated in previous years by other insects. Defoliation in one stand (South Woodstock) was heavy enough to cause refoliation. Populations of this insect may be on the increase. This is an early defoliator and should be checked in early June of 1983 for a possible increase in damage.

Locust Leaf Miner, Odontata dorsalis, caused only localized light defoliation in Windham, Addison, Chittenden and Lamoille Counties.

Elm Leaf Beetle, Pyrrhalta luteola, caused heavy defoliation of individual elms in Middlebury, and again, caused moderate to heavy defoliation of roadside elms in the Marshfield-Plainfield area. It was observed occasionally in southern Vermont.

Eastern Tent Caterpillar, Malacosoma americanum, populations are at relatively low levels throughout the State.

Mountain Ash Sawfly, Pristophora geniculata, caused scattered heavy defoliation of ornamental mountain ashes throughout much of the State, with the most reports being received from Caledonia County.

An unknown ash defoliator, probably a sawfly, caused moderate to heavy defoliation of roadside white ash trees in Groton State Forest. The smallest trees, particularly saplings, received the most damage.

Uglynest Caterpillar, Archips ceiasivoranus, was occasionally observed on chokecherry in Lamoille County.

The oak leaftier complex responsible for light defoliation of oak on 550 acres in Middlesex and Waterbury again caused only light defoliation. The primary defoliators are assumed to be those identified in the past, namely Psilicorsis reflexella, Tetralopha sp, Telephusa quercinigranciella, and Morrisonia confusa. Psilicorsis quercicella was observed in Windham County.

Large aspen tortrix, Choristoneura conflictana, again caused occasional light defoliation of roadside aspens in Orleans and Caledonia Counties. A trace infestation was also detected in the town of Brunswick in Essex County.

Birch Sawfly, Arge pectoralis, was reported for the first time defoliating gray birch in Colchester.

Birch Leaf Miner, Fenusa pusilla, caused its usual widespread damage to white and gray birch. Many shade tree calls concerning this insect were received in Addison County.

Cherry Scallop Shell Moth, Hydria prunivorata, was observed occasionally causing light defoliation in Windham and Windsor Counties. Damage was down sharply from 1981.

Spiny Elm Caterpillar, Nymphalis antiopa, damage was not reported this year even though the "Morning Cloak" adults were abundant early this spring following heavier than normal populations of the caterpillar last year.

Fall Webworm, Hyphantrea cunea, was reported from scattered locations in low numbers.

Satin Moth, Leucoma salicis, caterpillars caused light defoliation to ornamental silver poplar in Windsor County (Royalton).

Maple Petiole Borer, Caulocampus acericaulis, caused occasional damage in Windsor County.

Pear Sawfly, Caliroa cerasi, was observed again in Windsor County.

The following were not observed:

Linden Looper	Erranis tiliaria
Spring Cankerworm	Paleacrita vernata
Fall Cankerworm	Alsophila pometaria
Orange-Humped Mapleworm	Symmerista leucytis
Green Fruitworm	Lithophane antennata

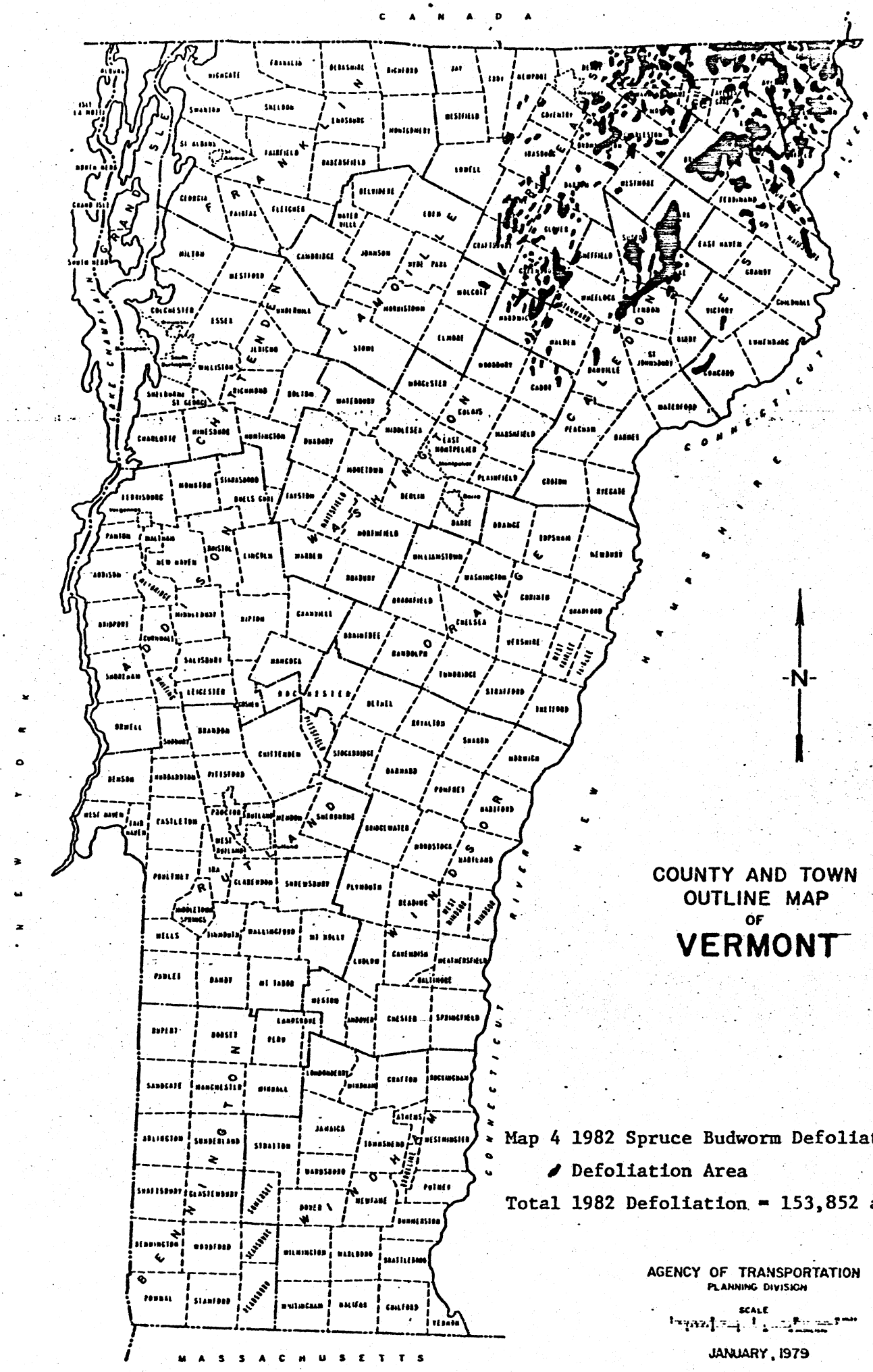
Softwood Defoliators

Spruce Budworm, Choristoneura fumiferana, defoliation of spruce-fir stands increased, spreading further south in Caledonia County and into Washington and Lamoille Counties (Map 4). Total acres defoliated is 153,852 (Table 7) compared to 96,466 acres in 1981.

TABLE 7 1982 SPRUCE BUDWORM DEFOLIATION

	Acres Defoliated [1]			
County	Light	Moderate	Heavy	Total
Caledonia	17,023	4,075	11,014	32,112
Essex	29,726	1,365	21,884	52,975
Lamoille	657	98	469	1,224
Orleans	17,574	20,021	26,914	64,509
Washington	1,791	1,158	83	3,032
Total	66,771	26,717	60,364	153,852

1. Light defoliation = yellow to light brown tops present
Moderate defoliation = red to brown color of top 50% or less of the crown on most trees
Heavy defoliation = red to brown color of over 50% of the crown on most trees. Stand Brown



COUNTY AND TOWN OUTLINE MAP OF VERMONT

Map 4 1982 Spruce Budworm Defoliation

Defoliation Area

Total 1982 Defoliation = 153,852 acres

AGENCY OF TRANSPORTATION
PLANNING DIVISION

SCALE

JANUARY, 1979

Mortality continues to increase in stands that have been repeatedly defoliated, with mortality now estimated to be occurring on 85,273 acre (Table 8).

TABLE 8 ACRES OF MORTALITY IN 1982 DUE TO SPRUCE BUDWORM

	Acres of Mortality[1]			
County	Light	Moderate	Heavy	Total
Caledonia	4,074	8,254	2,751	15,079
Essex	1,375	16,418	5,473	23,266
Orleans	20,012	20,187	6,729	46,982
Total	25,461	44,859	14,953	85,273

1. Light mortality = 1-10%,scattered or patchy
Moderate mortality = 10-25%, scattered
Heavy mortality = over 25%

Budworm-caused mortality of fir and spruce during 1981 over the entire spruce-fir acreage in the three counties most severely affected is estimated to be 12 and 1 trees per acre, respectively, representing 93 and 12 cubic feet per acre per year (Table 9).

TABLE 9 TREE MORTALITY[1] IN 1981 DUE TO SPRUCE BUDWORM

	No. of trees per acre		Volume (cu.ft.) per acre	
County	Fir	Spruce	Fir	Spruce
Caledonia	6.4	0.5	49.4	6.4
Essex	9.8	0.8	76.2	9.8
Orleans	19.8	1.7	153.4	19.8
Average	13	1	93	12

1. Average mortality that occurred in 1981 (total mortality minus pre-budworm annual mortality) per acre per year on the entire 288,100 acres of spruce-fir in the three county area.

If one assumes a timber value for stumpage of 10 dollars per cord and a conversion rate of 85 cubic feet per cord, then the total wood value of this annual loss is about 3.5 million dollars. Many of the stands being lost are valuable deer yards, which is another important concern.

An experimental spruce budworm control project was conducted in the Greensboro area in late May to test the effectiveness of Bacillus thuringiensis. The project was funded by a joint Canada-USA cooperative spruce budworm program known as CANUSA, and was directed by Dr. Bruce Parker, entomologist from the University of Vermont, with the cooperation of the U. S. Forest Service and many personnel from the Vermont Department of Forests, Parks and Recreation. Many of the plots were located within a critical deer yard area that accounts for 14 percent of the deer winter range in Orleans and Caledonia Counties. Spraying was conducted in late May on 25 spruce-fir plots averaging about 30 acres each. A Thuricide B.t. product was aerially applied at rates ranging from 8 to 16 Biological International Units (BIU) in ½ to 1 gallon of water per acre. Efficacy data from the project has not been analyzed but preliminary observations indicate good foliate protection at the higher concentrations of B.t.

Spruce budworm populations are expected to continue to increase in 1982. Moth catches in pheromone traps placed in lightly infested stands south of the generally infested area increased somewhat over 1981 trap catches. Budworm larvae within heavily infested stands showed no signs of collapse this summer but we will have a better idea of the trend in these stands when our overwintering larval survey is completed by the end of this year.

Spruce Bud Moth, Zeiraphera canadensis, was again abundant on white spruce in northern Vermont, causing light feeding on new growth similar to that caused by early instar spruce budworm larvae. Heaviest infestations were again in western Caledonia County, especially on open-grown trees. The insect was also observed in Windsor County.

Introduced Pine Sawfly, Diprion similis, larvae were more abundant than usual on white pines, resulting in a number of shade tree calls in Lamoille, Washington and Windsor Counties during late summer. Only light defoliation was observed.

Red-headed Pine Sawfly, Neodiprion lecontei, was detected causing light defoliation of red pine in Lamoille, Bennington and Rutland Counties.

Arborvitae Leaf Miner, Argyresthia thiuella, damage to cedar continued to be light.

Larch Casebearer, Coleophora laricella, populations continued at very light levels, with no noticeable damage.

Web Spinning Sawfly, Cephalcia sp, was observed on red pine in Bennington County (Dorset).

The following were not observed:

Yellow-Headed Spruce Sawfly	Pikonema alaskensis
Larch Sawfly	Pristophora erichsonii
White Pine Sawfly	Neodiprion pinetum

Sapsucking Insects, Midges and Mites

Balsam Gall Midge, Paradiplosis tumifex, populations increased in most balsam fir Christmas tree locations resulting in numerous unmarketable trees. Warm, dry weather in May during adult emergence probably resulted in highly successful egg laying this year. Several Christmas tree growers in Caledonia, Orleans, Washington, Lamoille, Windsor and Orange Counties resorted to chemical control with Diazion AG500. Twelve plantations totaling over 100 acres are known to have been treated using various types of ground equipment with poor to good results. Those who had treated the same area last year generally found that results were somewhat poorer this year, even with the same timing of applications. One 15 acre plantation in Derby was aerially treated, with good results.

Balsam Woolly Aphid, Adelges piceae, populations remain stable, with only a few balsam firs dying annually in stands previously infected. One new infestation was detected in the town of Troy.

Balsam Twig Aphid, Mindarus abietinus, appears to be increasing everywhere. It caused occasional damage to balsam fir Christmas trees. Syrphid fly larvae and ladybird beetle larvae were observed in association with heavy infestations.

Eastern Spruce Gall Aphid, Adelges abietis, damage to ornamental spruces and Christmas trees was about as common a problem as in the past, being heaviest on individual trees in widely scattered locations.

Cooley Spruce Gall Aphid, Adelges cooleyi, caused widespread yellowing and crooking of Douglas fir needles in a Christmas tree plantation in Warren.

A Root Aphid, Prociphilus americanus, was associated with heavy mortality of balsam fir seedlings in one Christmas tree plantation in Morrisville.

Pine Bark Aphid, Pineus strobi, was common on white pine at moderate population levels. In southern Vermont, levels are down from 1981.

Pine Needle Scale, Phenacaspis pinifoliae, caused light damage to red pine in Middlesex.

Fletcher Scale, Lecanium fletcheri, was reported to be damaging an ornamental yew in Craftsbury.

Pine Spittlebug, Aphrophora parallela, populations have increased in Caledonia County to the point where Christmas tree growers in the Lyndonville area are showing concern.

Woolly Elm Aphid, Eriosoma americana, caused the curling of leaves on ornamental elms in Morrisville and Lyndonville.

Woolly Alder Aphid, Prociphilus tessellatus, caused the curling of leaves on ornamental silver maples in Morrisville.

A birch lace bug, Corythucha spp., was discovered causing light damage to leaves of yellow and white birch in Morrisville, Elmore and Groton, in association with birch skeletonizer and birch leaf folder.

Spruce Spider Mite, Oligonychus ununguis, caused moderate damage to a few white spruces in a Christmas tree plantation in East Berkshire, as well as scattered light damage to balsam fir Christmas trees in Caledonia and Lamoille Counties.

Bud, Shoot and Stem Insects

Balsam Shootbearing Sawfly, Pleroneura brunneicornis, caused an increasing amount of shoot injury to balsam fir, especially in Christmas tree plantations, throughout Orleans, Caledonia and Lamoille Counties. Some small individual trees in Morrisville were observed to have more than half their shoots mined by this insect in late May. Damage is usually restricted to a loss of just the tips of the new growth but some shoots fail to continue growing and severe infestation on individual Christmas trees resulted in some disfigurement.

White Pine Weevil, Pissodes strobi, damage to spruce and pine terminals remains stable at moderate levels.

Pales Weevil, Hylobius pales, caused only light to moderate damage to Scots pine in scattered locations.

Northern Pine Weevil, Pissodes approximatus, was observed in Windham & Rutland Counties.

A pine shootborer, probably Eucosma gloriola, caused damage to Scots pine in Walden, which was lighter than in previous years.

Locust Borer, Megacyllene robiniae, was observed causing heavy damage to young black locust trees in Windsor County.

Twig Pruner, Elaphidionoides villosus, was reported causing branch drop on english walnut in Cornwall.

Buffalo Treehopper, Stictocephala bubalus, egg laying damage caused the death of terminals on ornamental sugar maple saplings in Cornwall.

Roundheaded Apple Tree Borer, Saperda candida, damaged ornamental fruit trees in Greensboro and Danville and mountain ashes in Middlebury.

Bark Beetles

Eastern Larch Beetle, Dendroctonus simplex, continues to be associated with Larch Decline.

Pine Engraver, Ips pini, was associated with mortality of stressed pine on a one acre poletimber plantation in Richmond, grazing damage on the sandy site combined with drought conditions in previous years is assumed to be the primary cause of mortality of more than half the trees. This insect also attacked white pine in Bennington County stressed by winter burn, and red pine in Rutland County on a wet site. The red pine were subsequently attacked by the red turpentine beetle, Dendroctonus rufipennis.

FOREST DISEASES

Stem Diseases

Scleroderris Canker, caused by Gremmeniella abietina, was not found in any new towns this year and the quarantine area remains the same as in 1981 (Map 5). Only pine trees in quarantined towns require inspection and this year, 57 pine plantations in 31 towns were inspected and found free of the disease. Another 46 pine plantations in 14 towns bordering the existing quarantine zone were surveyed, also with negative results.

Infected branches were much more prevalent in June in previously infected plantations than they were a year ago, indicating that there was probably a good infection period during the later half of 1981. Number of plantations infected remains at 94, consisting of 83 red pine plantations and 11 Scots pine plantations, representing 728 and 39 acres, respectively. Tree mortality remains limited to 8 plantations comprising 40 acres.

Beech Bark Disease, caused by Cryptococcus fagi, and Nectria coccinea var. faginata, continues to cause light beech mortality throughout. Damage was heavier than usual in some parts of Rutland County where damage was heavy ten years ago (Map 6). In northern Vermont mortality is occurring at a slower rate than in the past. Beech scale populations, though still light, appear to be increasing in most beech stands.

White Pine Blister Rust, caused by Cronartium ribicola, appears to be stable at fairly low infection rates in most locations.

Dutch Elm Disease, caused by Ceratocystis ulmi, continues to kill many elms with many young trees killed again this year. In southern Vermont it appears to be heavier than normal. The country club in Springfield has initiated an injection program in cooperation with the Elm Research Institute. The Town of Woodstock continues to have such a program.

Cytospora Canker, caused by Cytospora kunzei, remains a common cause of branch mortality of white and blue spruce, especially the latter.

Hypoxylon Canker, caused by Hupoxylon pruinatum, remains widespread on aspen. In addition to causing mortality, many snapped stems were observed following heavy windstorms.

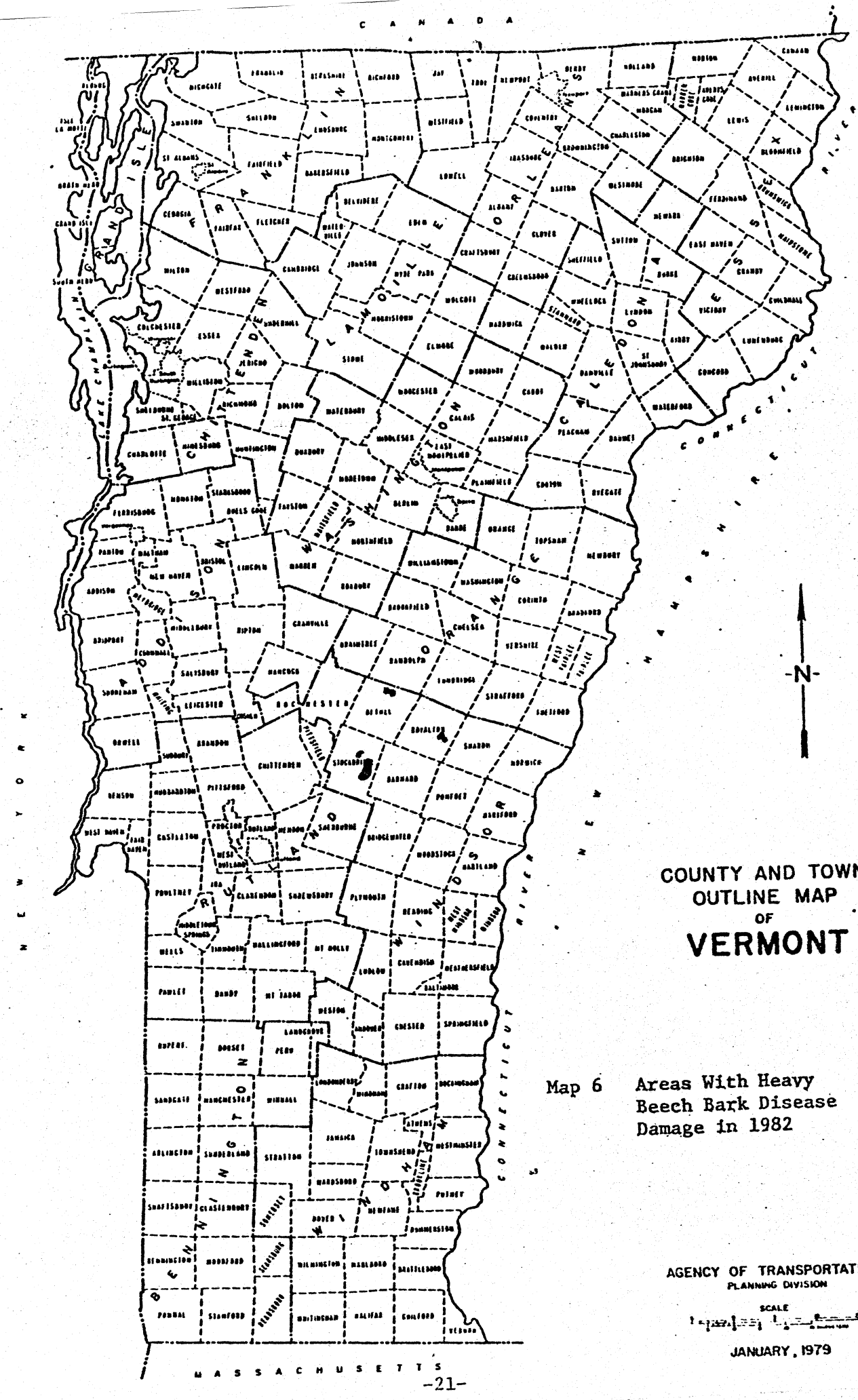
Verticillium Wilt, caused by Verticillium albo-atrum, was associated with dying maples in Rutland County.

Black Knot, caused by Apiosporina morbosum, remains widespread, and appears to occur in pockets.

Fireblight, caused by Erwinia amylovora, caused branch dieback of an ornamental mountain ash in Lincoln, as well as on numerous apple trees in Caledonia County.

Foliage Diseases

Fir-Fern Rust of balsam fir, caused principally by Uredinopsis mirabilis, caused only scattered light damage to balsam fir Christmas trees this year.



COUNTY AND TOWN OUTLINE MAP OF VERMONT

Map 6 Areas With Heavy Beech Bark Disease Damage in 1982

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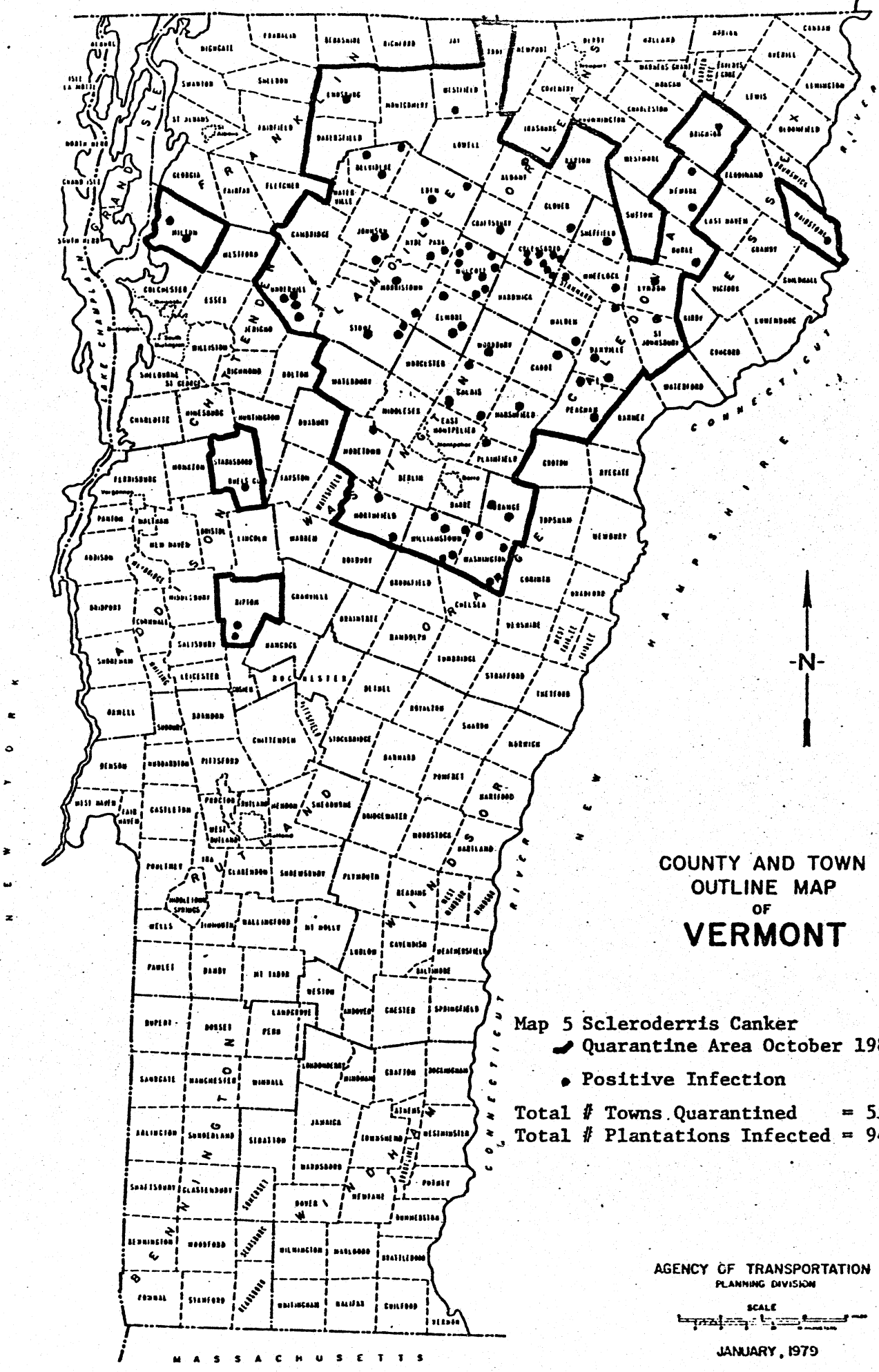
PLANNING DIVISION

SCALE

JANUARY, 1979


CANADA
NEW YORK
MASSACHUSETTS
CONNECTICUT RIVER
-N-
COUNTY AND TOWN
OUTLINE MAP
OF
VERMONT
Map 5 Scleroderris Canker
Quarantine Area October 1982
Positive Infection
Total # Towns Quarantined = 55
Total # Plantations Infected = 94
AGENCY OF TRANSPORTATION
PLANNING DIVISION
SCALE
JANUARY, 1979

Lophodermium Needle Cast, caused by Lophodermium pinastri, was responsible for some needle loss in scattered Scots pine Christmas trees but damage was very light this year.

Swiss Needlecast, caused by Phaeocryptopus guamani, caused moderate to heavy damage to one Douglas-fir Christmas tree plantation in Williamstown and another in Moretown, totaling about 5 acres. It was also responsible for heavy damage to Douglas-fir ornamentals in Johnson.

Weir's Spruce Cushion Rust, caused by Chrysomyxa weirii, was identified by Dr. Dale Bergdahl, Forest Pathologist with the University of Vermont, as the cause of needle loss on several blue spruce Christmas trees in Bakersfield. This appears to be a new U. S. host record for this fungus.

Balsam Fir Tip Blight, caused by Rehmiellopsis balsameae, was tentatively identified as the cause of tip mortality within an acre of balsam fir Christmas trees in North Pownal. About 5 percent of the trees were reported to be infected, with most damage in the shadiest corner of the plantation and the shadiest side of the trees. A couple of trees lost half their tips but most had only 4-5 infected tips. Branch samples submitted fit the description of this organism but the fruiting bodies (which were present) do not produce spores until the following spring.

Diplodia Tip Blight, caused by Diplodia pini, was causing dieback on ornamental red pine in Windham County (Wilmington).

An unidentified foliage disease wiped out a shipment of balsam fir wildings transplanted in Rutland County.

Root Rots

Annosus Root Rot, caused by Heterobasidion annosum, was discovered to be the cause of occasional red pine mortality within a 55 acre red pine plantation in Williamstown owned by the town of Barre. This plantation was last surveyed for presence of this disease in 1970 just previous to thinning. Results of the survey were negative but the stumps were treated with borax anyway because of the proximity (3.5 miles) to another infected stand in Berlin. The logger who did the thinning in 1970 was reported to have been less than thorough with his stump treatments, which could account for the present infections. In southern Vermont, damage is light in old infection centers.

Shoestring Root Rot, caused by Armillaria mellea, was frequently found invading the root collar of sugar maples which were dead or dying due to severe crown dieback following heavy defoliation by forest tent caterpillar or saddled prominent. Fruiting bodies were numerous in those areas in the fall. It was also associated with mortality of several stressed ornamentals in Windsor and Rutland Counties. In one area, inoculum levels were so high that an apparently healthy young oak adjacent to a recent stump died suddenly. Fruiting bodies of this fungus were found frequently in hardwood stands which had been recently defoliated.

Diebacks, Declines and Environmental Diseases

Larch Decline and mortality continues to be prevalent, but fewer trees were observed to be dying this year than in the past. In some stands, however, mortality of previously symptomatic trees is approaching 100%. The total area known to be affected is about 9,000 acres, with acreage increases observed in the two counties with the most damage - Caledonia and Orleans. Much of the remaining damage is in Washington, Rutland and Orange Counties, although some larch decline can be found in every county in the state. The Pinewood Nematode, Bursaphelenchus xylophilus, or a closely related nematode was isolated by Dr. Dale Bergdahl from dying larch trees in every county except Franklin, Grand Isle, Bennington and Addison. Whether these nematodes are responsible for any of the decline has yet to be shown. Heavy populations of the eastern larch beetle are also associated with the decline.

Ash Dieback symptoms were widespread, and appear to be increasing in southern Vermont.

Wind Burn affected approximately 2,000 acres in Bennington County (Map 7). Two severe windstorms affected trees on slopes with eastern aspects. The first storm lasted about 56 hours with no rain around the end of May; the second in July lasted 20 hours. After the first storm about half of the foliage of all species showed marginal necrosis. The second storm broke off the dehydrated portions. Logging operations have been postponed in some of these areas. Marginal necrosis in parts of southern Windham County may also be due to wind burn.

Maple Decline continues to be common, especially on roadside trees and on improperly planted or poorly maintained ornamental sugar maples, as well as in certain stands that have suffered heavy defoliation in recent years.

Leaf Scorch, caused by drought conditions in mid to late summer, was common in Caledonia and Orleans Counties. This was especially true at the higher elevations with shallow soils.

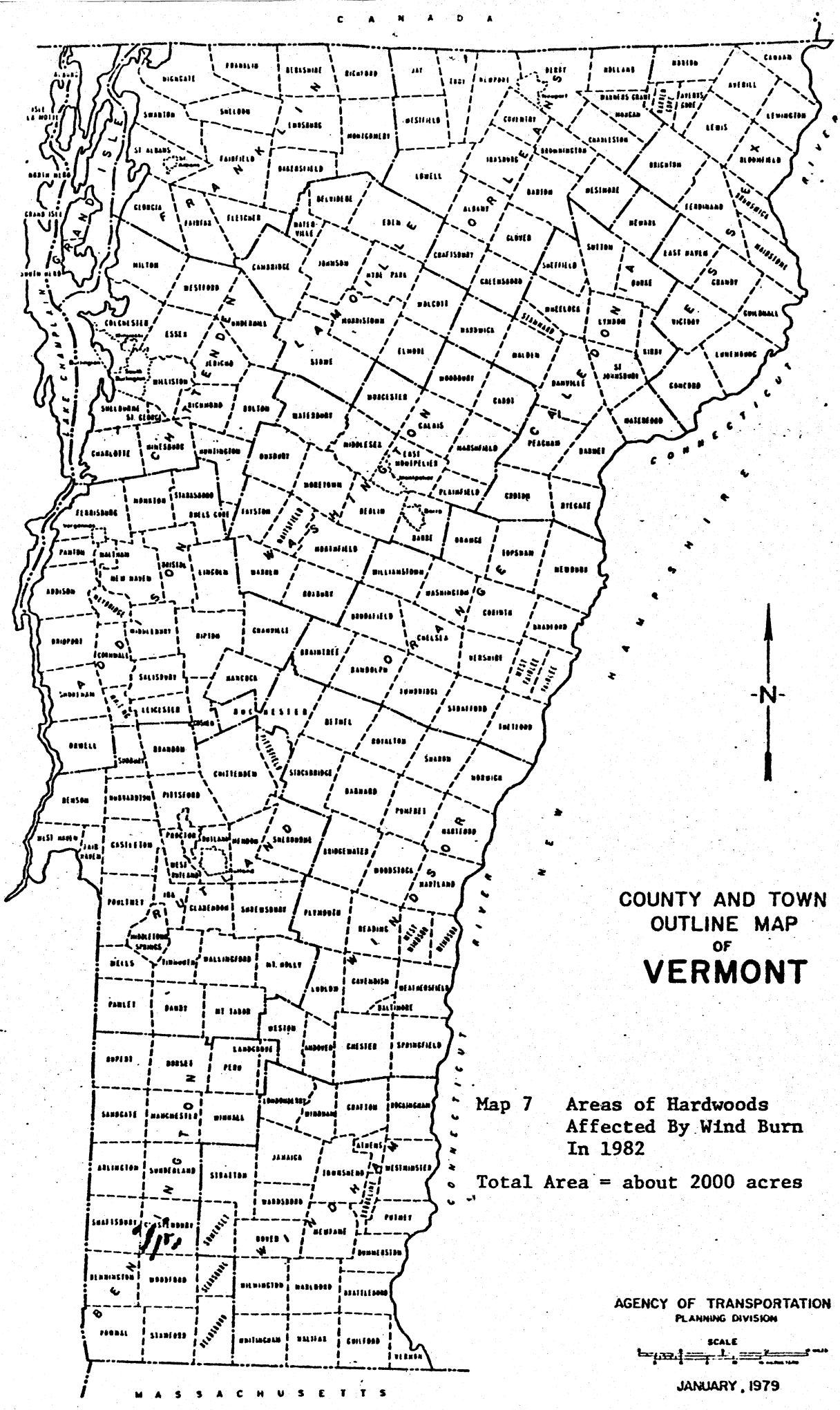
A heavy seed crop on red maple, mentioned in the Introduction, was prevalent throughout the region, resulting in bare tops on many trees. These trees may suffer some crown dieback, which won't be apparent until next spring.

Red Spruce Decline continues to occur in scattered locations, including well-drained and shallow sites.

Numerous shade trees have been killed in the last two years by landowners coating their tree trunks with grease or vaseline to halt the advance of caterpillars. Most of them had heard that this was harmful, but not in time to save their trees.

Animal Damage

Mouse damage was more noticeable than in recent years, especially on roadside trees. A few homeowner complaints on mouse-girdled ornamental maples and crab apples were received in Lamoille County. In each case, tall grass left around the trees had encouraged a mouse problem.



COUNTY AND TOWN OUTLINE MAP OF VERMONT

Map 7 Areas of Hardwoods Affected By Wind Burn In 1982

Total Area = about 2000 acres

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SCALE

JANUARY, 1979

Porcupine damage continues to be increasing slightly in many areas.

Red Squirrel damage to sugar maple tubing occurred in scattered locations in Windsor, Orleans, Caledonia, Lamoille, Franklin and Addison Counties. Overall damage was less than in 1981, except for Franklin County where many complaints were received this past season.

This damage has been observed to occur at all times of the year, although it is least likely in summer. Zinc phosphide-treated bait can be used to control squirrels in sugarbushes provided it is placed in an approved bait station, i.e., Eaton or Solvit, and applications are in accordance with a use direction label, which must be obtained from the Vermont Department of Agriculture. Two owners in Windsor County requested assistance for control.

Deer browse damage was heavy in areas where yarding occurred. Damage occurred to about 900 Christmas trees in one area in Bennington County (Pownal).

The Beech Bark Disease Today In The Northeastern U.S.

ABSTRACT—The beech bark disease, caused by fungi (principally Nectria coccinea *var.* faginata) *infecting minute feeding wounds made by scale insects (principally* Cryptococcus fagi) *in the bark of beech* (Fagus grandifolia), *is well established in the eastern United States and is spreading. Many beech trees are killed and weakened in infected stands, although some trees seem to have a natural resistance to the disease. There was little real concern about the disease in the U.S. until the last few years, when industries learned to use beech profitably. Now there is a need for better understanding of the disease.*

The beech bark disease presents an ironic paradox in the Northeast today.

In the early 1930's, there was great concern over the beech bark disease, primarily because it was new. It was spectacular. No one could miss seeing the infested trees, the bright red perithecia and the decimated forests. Then the concern waned rapidly. Forest managers welcomed the disease because it was killing the big weed tree of the forest. Wood industries used very little beech, so there was no economic loss.

In the last decade, however, the wood industries have learned to dry and use beech profitably. The supply was plentiful and the price low.

Now that beech has gained acceptance, the beech bark disease is threatening the supply. For the first time real concern is developing over the disease. Questions are being asked: What can we do? Why don't we know more about this disease that has been here so long? The situation will get worse as the disease moves westward into areas where beech is dying because of a beech decline and injury caused by an oyster scale.

In Europe, the disease has invaded all the beech forests. There are many healthy beech trees in Europe now, but where there are diseased trees only the aftermath stage is present. Mortality is not so common. In the United States, the disease has vast areas of beech forest yet to attack, and the disease is moving rapidly.

This article is a summary of what we know about the disease now, with some pointers toward what we still need to know.

Alex L. Shigo

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Cause of Disease

The beech bark disease, as it exists in the northeastern United States, is caused by fungi infecting minute feeding wounds made by scale insects in the bark of beech. The principal fungus is *Nectria coccinea* var. *faginata* Lohman, A. J. Wats., and Ayres (1). *Nectria galligena* Bres. and possibly other species of *Nectria* are also thought to be involved (*10*).

found around these dead spots. The dead areas may extend into the sapwood. These spots are usually delimited by callus tissue.

Areas devoid of the scale insects or patches of black wool indicate one of the first places killed by *Nectria* (*Fig. 2*). The insects cannot live on dead tissue; and, as they die, a black fungus frequently grows over them.

The fungus may infect large areas on some trees, completely girdling them. The leaves that do come out in the spring do not mature, giving the crowns an open appearance. The leaves turn yellow and usually remain on the tree during the summer season. The chlorotic crowns are typical of trees dying from a water deficiency.

Frequently the fungus infects only narrow strips on the bole, and the subsequent symptoms differ from those of trees that have been girdled. Callus tissue forms around these cankers, and the bark becomes very roughened. Parts of the crown become chlorotic and die. Small cankers may be walled off from the sapwood by callus tissue.

Many of the trees that are partially girdled remain alive in a weakened state for many years, while others are broken by the wind.

Fig. 2. The strip of bark devoid of the beech scale on this tree indicates that the bark was killed by the *Nectria* fungus. The scale insects cannot live in dead bark.

Spread

The disease, once established, began to spread rapidly through the forests that contained an abundance of beech. Beech had been considered an undesirable tree, and it was left after other species were cut. It also regenerated quickly in the spaces left after other trees were cut.

The disease spread southward into Maine and then turned westward into the forests of New Hampshire and Vermont. By 1950, the disease was well established on the eastern slopes of the White Mountains in New Hampshire. By 1960, it was entering the center of Vermont.

Now the disease has spread to central New York throughout Massachusetts and Connecticut and to the northern portions of Pennsylvania. In neighboring Canada, the disease has moved along the northern border of the St. Lawrence River to Lake Ontario.

Impact

Although the disease is now spread over a broad area of the northeastern United States and Canada, the impact of the disease on the trees varies greatly in different areas. One would find it difficult to believe that the disease as it is now found in Maine is the same as that found in Vermont.

The disease can be separated into at least three stages: (1) the advance front, (2) the killing front, and (3) the aftermath stage.

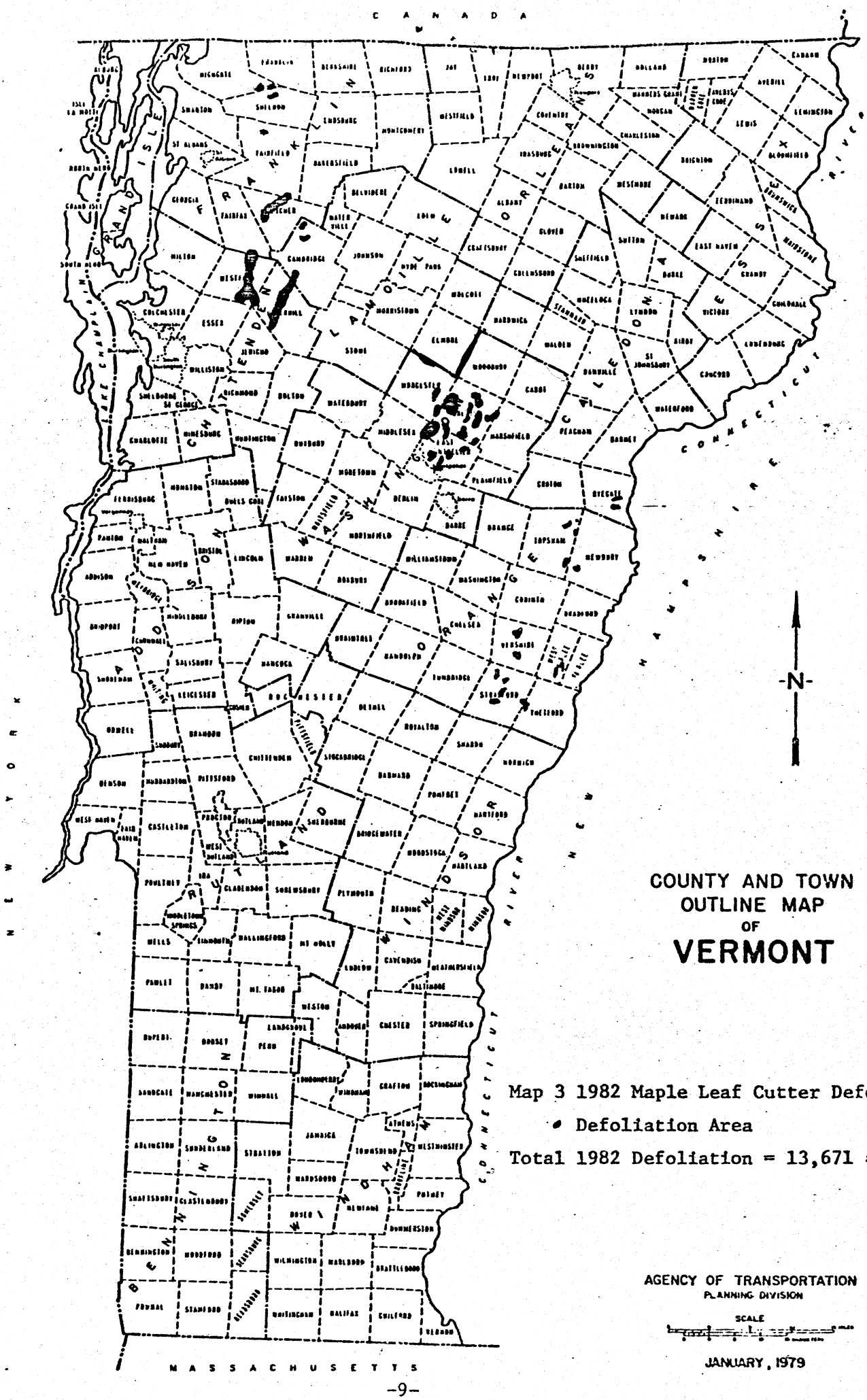
The advance front is now in central New York. Some insects can be found, but the bright red perithecia of *N. coccinea* var. *faginata* are scarce.

The killing front is now in Vermont and eastern New York. Here the trees are dying rapidly over large areas of forests. The insects are obvious, and the red perithecia can be found on some trees.

The aftermath zone stretches from Vermont eastward to the coastal areas. Beech trees that were apparently resistant are still thriving in these areas. There are trees with all gradations of injury from a few small cankers to most of the stem killed, and many other microorganisms and insects have attacked the weakened trees.

Other Microorganisms and Insects on Weakened Beech

A mycoparasite, *Gonatorrhediella highlei* A. L. Smith frequently attacks the beech parasite, *N. coccinea* var. *faginata* (*9*). In culture, *G. highlei* inhibits sporulation of *N. coccinea* var. *faginata*. The mycoparasite is


CANADA
NEW YORK
MASSACHUSETTS
CONNECTICUT RIVER
-N-
COUNTY AND TOWN
OUTLINE MAP
OF
VERMONT
Map 3 1982 Maple Leaf Cutter Defoliatio
Defoliation Area
Total 1982 Defoliation = 13,671 acres
AGENCY OF TRANSPORTATION
PLANNING DIVISION
SCALE
JANUARY, 1979